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1 [Multi-resolution representations: Interactive visualization of unstructured grids using hierarchical 3D textures](#)

Joshua Leven, Jason Corso, Jonathan Cohen, Subodh Kumar

 October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and graphics**

 Full text available: [pdf\(2.83 MB\)](#)

 Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We present a system for interactively rendering large, unstructured grids. Our approach is to voxelize the grid into a 3D voxel octree, and then to render the data using hierarchical, 3D texture mapping. This approach leverages the current 3D texture mapping PC hardware for the problem of unstructured grid rendering. We specialize the 3D texture octree to the task of rendering unstructured grids through a novel *pad and stencil* algorithm, which distinguishes between data and non-data voxel ...

2 [Multiresolution signal processing for meshes](#)

Igor Guskov, Wim Sweldens, Peter Schröder

 July 1999 **Proceedings of the 26th annual conference on Computer graphics and interactive techniques**

 Full text available: [pdf\(10.67 MB\)](#)

 Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

Keywords: Laplacian pyramid, irregular connectivity, meshes, multiresolution, subdivision, surface parameterization, wavelets

3 [Poster session: Adaptive and quality 3D meshing from imaging data](#)

Yongjie Zhang, Chandrajit Bajaj, Bong-Soo Sohn

 June 2003 **Proceedings of the eighth ACM symposium on Solid modeling and applications**

 Full text available: [pdf\(558.09 KB\)](#)

 Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This paper presents an algorithm to extract adaptive and quality 3D meshes directly from volumetric imaging data - primarily Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). The extracted tetrahedral and hexahedral meshes are extensively used in finite element simulations. Our comprehensive approach combines bilateral and anisotropic (feature specific) diffusion filtering, with contour spectrum based, isosurface and interval volume selection. Next, a top-down octree subdivision cou ...

Keywords: 3D meshes, adaptive, feature sensitive, hanging nodes, quality

4 Robust adaptive floating-point geometric predicates

Johnathan Richard Shewchuk

May 1996. **Proceedings of the twelfth annual symposium on Computational geometry**

Full text available:  [pdf\(1.25 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)



5 Multiresolution modeling and visualization of volume data based on simplicial complexes

Paolo Cignoni, Leila De Floriani, Claudio Montani, Enrico Puppo, Roberto Scopigno

October 1994 **Proceedings of the 1994 symposium on Volume visualization**


Full text available:  [pdf\(1.59 MB\)](#) Additional Information: [full citation](#), [citations](#), [index terms](#)



6 Multiresolution compression and reconstruction

Oliver G. Staadt, Markus H. Gross, Roger Weber

October 1997 **Proceedings of the 8th conference on Visualization '97**

Full text available:  [pdf\(1.55 MB\)](#)  Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)
[Publisher Site](#)




Keywords: isosurfaces, meshing, oracles, tetrahedralization, triangulation; volumes, wavelets

7 The power crust

Nina Amenta, Sunghee Choi, Ravi Krishna Kolluri

May 2001 **Proceedings of the sixth ACM symposium on Solid modeling and applications**

Full text available:  [pdf\(1.17 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The *power crust* is a construction which takes a sample of points from the surface of a three-dimensional object and produces a surface mesh and an approximate medial axis. The approach is to first approximate the medial axis transform (MAT) of the object. We then use an inverse transform to produce the surface representation from the MAT.


This idea leads to a simple algorithm with theoretical guarantees comparable to those of other surface reconstruction and medial axis approxi ...



8 Adaptively sampled distance fields: a general representation of shape for computer graphics

Sarah F. Frisken, Ronald N. Perry, Alyn P. Rockwood, Thouis R. Jones

July 2000 **Proceedings of the 27th annual conference on Computer graphics and interactive techniques**

Full text available:  [pdf\(476.42 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Adaptively Sampled Distance Fields (ADFs) are a unifying representation of shape that integrate numerous concepts in computer graphics including the representation of geometry



and volume data and a broad range of processing operations such as rendering, sculpting, level-of-detail management, surface offsetting, collision detection, and color gamut correction. Its structure is uncomplicated and direct, but is especially effective for quality reconstruction of complex shapes, e.g., artistic a ...

Keywords: carving, distance fields, graphics, implicit surfaces, level of detail, rendering, volume modeling, volume rendering

9 Triangulations in CGAL (extended abstract)

Jean-Daniel Boissonnat, Olivier Devillers, Monique Teillaud, Mariette Yvinec

May 2000 **Proceedings of the sixteenth annual symposium on Computational geometry**


Full text available:  pdf(793.02 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)



10 Time-varying datasets and remote rendering: Space-time points: 4d splatting on efficient grids

Neophytos Neophytou, Klaus Mueller

October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and graphics**

Full text available:  pdf(1.48 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)



4D datasets, such as time-varying datasets, usually come on 4D Cartesian Cubic (CC) grids. In this paper, we explore the use of 4D Body Centered Cubic (BCC) grids to provide a more efficient sampling lattice. We use this lattice in conjunction with a point-based renderer that further reduces the data into an RLE-encoded list of relevant points. We achieve compression ranging from 50 to 80% in our experiments. Our 4D visualization approach follows the hyperslice paradigm: the user first specifies ...

11 Computational fluid dynamics I: AUFLIC: an accelerated algorithm for Unsteady Flow Line Integral Convolution

ZhanPing Liu, Robert James Moorhead

May 2002 **Proceedings of the symposium on Data Visualisation 2002**

Full text available:  pdf(901.10 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)




UFLIC (Unsteady Flow Line Integral Convolution) is an effective texture synthesis technique to visualize unsteady flow with enhanced temporal coherence, but it is time-consuming to generate. This paper presents an accelerated algorithm, called AUFLIC (Accelerated UFLIC), to speed up the UFLIC generation. Our algorithm saves, re-uses, and updates pathlines in the value scattering processes. A flexible seeding strategy is introduced so that a seed particle may be directly extracted from the previous ...

Keywords: LIC, UFLIC, convolution, flow field, pathline, texture synthesis, unsteady flow visualization

12 Hardware assisted unstructured volume rendering: Multiresolution view-dependent splat based volume rendering of large irregular data

Jeremy Meredith, Kwan-Liu Ma

October 2001 **Proceedings of the IEEE 2001 symposium on parallel and large-data visualization and graphics**

Full text available:  pdf(4.70 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)



We present techniques for multiresolution approximation and hardware-assisted splat based rendering to achieve interactive volume visualization of large irregular data sets. We examine two methods of generating multiple resolutions of irregular volumetric grids and a data structure supporting the splatting approach for volume rendering. These techniques are implemented in combination with a view-dependent error based resolution selection to maintain accuracy at both low and high zoom levels. In ...

Keywords: Hardware-assisted rendering, irregular-grid data, lighting, multiresolution representation, splatting, volume rendering

13 Discrete multiscale vector field decomposition

Yiying Tong, Santiago Lombeyda, Anil N. Hirani, Mathieu Desbrun

July 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 3

Full text available:  [pdf\(8.65 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)

While 2D and 3D vector fields are ubiquitous in computational sciences, their use in graphics is often limited to regular grids, where computations are easily handled through finite-difference methods. In this paper, we propose a set of simple and accurate tools for the analysis of 3D discrete vector fields on arbitrary tetrahedral grids. We introduce a variational, multiscale decomposition of vector fields into three intuitive components: a divergence-free part, a curl-free part, and a harmonic ...

Keywords: Hodge decomposition, animation, scale-space description, variational approaches, vector fields, visualization

14 Session C1: volume rendering: Immersive volume visualization of seismic simulations: a case study of techniques invented and lessons learned

Prashant Chopra, Joerg Meyer, Antonio Fernandez

October 2002 **Proceedings of the conference on Visualization '02**

Full text available:  [pdf\(15.20 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This paper is a documentation of techniques invented, results obtained and lessons learned while creating visualization algorithms to render outputs of large-scale seismic simulations. The objective is the development of techniques for a collaborative simulation and visualization shared between structural engineers, seismologists, and computer scientists. The computer graphics research community has been witnessing a large number of exemplary publications addressing the challenges faced while tr ...

Keywords: level-of-detail, mesh simplification, multi resolution, unstructured meshes

15 Linear and Cubic Box Splines for the Body Centered Cubic Lattice

Alireza Entezari, Ramsay Dyer, Torsten Moller

October 2004 **Proceedings of the conference on Visualization '04**

Full text available:  [pdf\(793.03 KB\)](#)


Additional Information: [full citation](#), [abstract](#)

In this paper we derive piecewise linear and piecewise cubic box spline reconstruction filters for data sampled on the body centered cubic (BCC) lattice. We analytically derive a time domain representation of these reconstruction filters and using the Fourier slice-projection theorem we derive their frequency responses. The quality of these filters, when used in reconstructing BCC sampled volumetric data, is discussed and is demonstrated with a raycaster. Moreover, to demonstrate the superiority ...

Keywords: Body Centered Cubic Lattice, Reconstruction, Optimal Regular Sampling

16 Computational geometry: a retrospective

Bernard Chazelle

May 1994 **Proceedings of the twenty-sixth annual ACM symposium on Theory of computing**Full text available:  [pdf\(2.20 MB\)](#)Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)**17 Session 1: Spectral surface reconstruction from noisy point clouds**


Ravikrishna Kolluri, Jonathan Richard Shewchuk, James F. O'Brien

July 2004 **Proceedings of the 2004 Eurographics/ACM SIGGRAPH symposium on Geometry processing**Full text available:  [pdf\(708.26 KB\)](#)Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)


We introduce a noise-resistant algorithm for reconstructing a watertight surface from point cloud data. It forms a Delaunay tetrahedralization, then uses a variant of spectral graph partitioning to decide whether each tetrahedron is inside or outside the original object. The reconstructed surface triangulation is the set of triangular faces where inside and outside tetrahedra meet. Because the spectral partitioner makes local decisions based on a global view of the model, it can ignore outliers, ...

18 A Delaunay based numerical method for three dimensions: generation, formulation, and partition

Gary L. Miller, Dafna Talmor, Shang-Hua Teng, Noel Walkington

May 1995 **Proceedings of the twenty-seventh annual ACM symposium on Theory of computing**Full text available:  [pdf\(1.19 MB\)](#)Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)**19 IEEE Visualization Cumulative Bibliography (1990 - 2004)**October 2004 **Proceedings of the conference on Visualization '04**Full text available:  [pdf\(811.24 KB\)](#)Additional Information: [full citation](#)**20 Topology-reducing surface simplification using a discrete solid representation**

Carlos Andújar, Pere Brunet, Dolors Ayala





April 2002 **ACM Transactions on Graphics (TOG)**, Volume 21 Issue 2Full text available:  [pdf\(3.75 MB\)](#)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper presents a new approach for generating coarse-level approximations of topologically complex models. Dramatic topology reduction is achieved by converting a 3D model to and from a volumetric representation. Our approach produces valid, error-bounded models and supports the creation of approximations that do not interpenetrate the original model, either being completely contained in the input solid or bounding it. Several simple to implement versions of our approach are presented and di ...

Keywords: Geometry simplification, multiresolution models, surface reconstruction

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